SR SSD 2002-27
9/2002

Technical Attachment

Incorporating Lightning Climatology in the Graphical Forecast Editor

Charles H. Paxton
WFO Tampa Bay Area
Ruskin, Florida

Introduction

The National Weather Service Graphical Forecast Editor (GFE) in AWIPS provides a bridge between data, models, and forecast products. It furnishes the capability for meteorologists to edit data which are in gridded form, output text products based on those gridded data, and also produce a wide variety of forecasts in graphical form. As part of the NWS Rapid Prototyping Project, WFO Tampa Bay Area has participated in development of the GFE with NOAA's Forecast Systems Laboratory. The system is enhanced by flexible Python scripting which permits extensive localization.

The GFE provides a method for input and manipulation of data from numerical forecast models to produce a localized forecast. At times, climatology may provide better guidance to the forecaster than model data. For example, Florida's warm season convective patterns are driven by local sea and land breezes that are influenced by larger scale wind regimes, which are in turn related to position and intensity of the mid-Atlantic ridge. These features have been thoroughly explored by many researchers. In particular, Lericos et al. (2000) produced a wind regime-based lightning climatology that is used as guidance for peninsular Florida summer forecasts. This climatology is based on seven common wind regimes and shows hourly cloud-to-ground lightning flash density. The data were converted to netCDF format for ingest into the GFE. A retrieval scheme was developed for inputting the data into the GFE grid manager, then scripts known as "Smart Tools" were developed for converting the lightning data into forecast grids.

López and Holle (1987) illustrated lightning distributions over portions of Florida as a function of the prevailing large-scale flow. Hodanish et al. (1997) produced a 10-year Florida lightning climatology that showed lightning flash density distribution by month over the state. They noted locations of lightning maxima that are coincident with features of the coastal geography such as peninsulas and bays, where sea and land breezes are known to produce convergent wind flows. Lericos et al. (2000) identified seven significant wind regimes over the Florida peninsula and surrounding waters during the warm season of May to September. Ten years of lightning data from 1989-1998 were incorporated into the study. Radiosonde data from the 1200 UTC soundings were used to calculate the 1000-700 mb mean vector wind for Tampa, Miami and Jacksonville. Lightning flashes were parsed into arrays for each hour within the study period based on wind regimes.

Methodology

The scripting and grid manipulation capability of the GFE software extends beyond input and manipulation of model data by providing methods to derive new forecast parameters. The lightning flash climatology provides a unique source of data from which many of the typical GFE-based forecast grids may be derived. This climatology may be used to infer weather type, precipitation amounts, sky cover, probability of precipitation (PoP), and, of course, lightning activity level (LAL). Lightning flash data may also be used to derive timing, intensity and location of land and sea breezes.

The first step in the process to provide a data source useable in the GFE was to convert the original lightning climatology arrays into netCDF format. Next, the localConfig file within the GFE is modified to produce a grid space and naming conventions for the data. A "Smart Initialization" file is used to initialize the data for GFE input. A GFE script called a "Procedure" (Fig. 1) copies, and renames with a current or future date, the netCDF file from a local directory into another directory that the GFE recognizes as a container for the gridded lightning data. The procedure then copies the directory into the GFE Grid Manager (Fig. 2). The next step is to run another procedure that runs user selectable scripts called Smart Tools, which convert data from one grid into another using a mathematical or relational formula. In this case, the Smart Tools convert lightning grids into weather, QPF, sky cover, PoP, and LAL grids.

Although this is a unique data set that can provide more detail than typical model input, several considerations are needed:

1) Wind regimes upon which the climatology is derived may not be representative of the current wind regime,
2) The climatology did not account for thermodynamic profiles which may differ from the current situation, and
3) Editing of the grids may be necessary.

Conclusion

The model data access and scripting capability of the GFE permits implementation of simple models or climatologies to produce new fields or enhance existing ones. In this paper, a methodology for using a lightning climatology was discussed as a method for deriving forecast grids commonly used within the GFE. Much of the basic grid editing is accomplished by using GFE Smart Tools that utilize key forecast fields to derive other fields. Certainly other climatologies in gridded form may be used for input into GFE grids as well. The GFE developers at FSL are to be commended for having the insight to build scripting flexibility in the GFE to accommodate unique data sets.

Acknowledgment

Appreciation is extended to Jason Burks, ITO at WFO Huntsville, for converting the original study data into netCDF format and working out original retrieval schemes.

References

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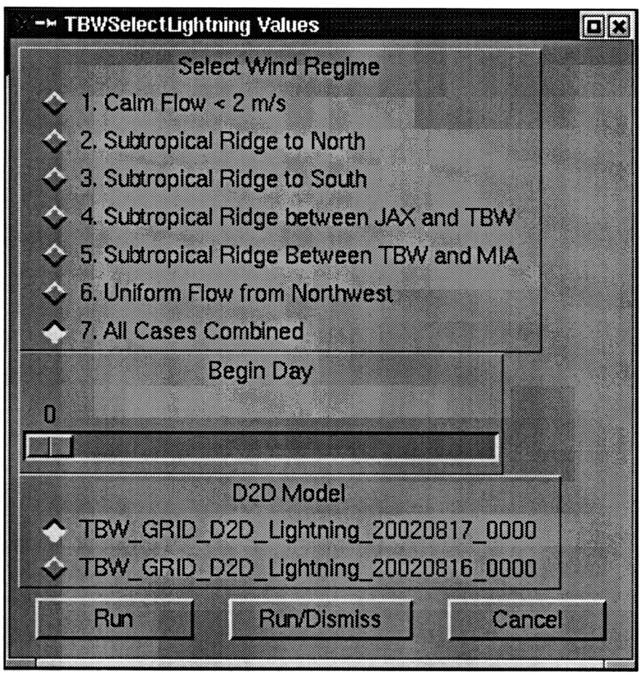

Figure 1. A GFE script called a "Procedure" which copies and renames with a current or future date, the netCDF file from a local directory into another directory that the GFE recognizes as a container for the gridded lightning data.

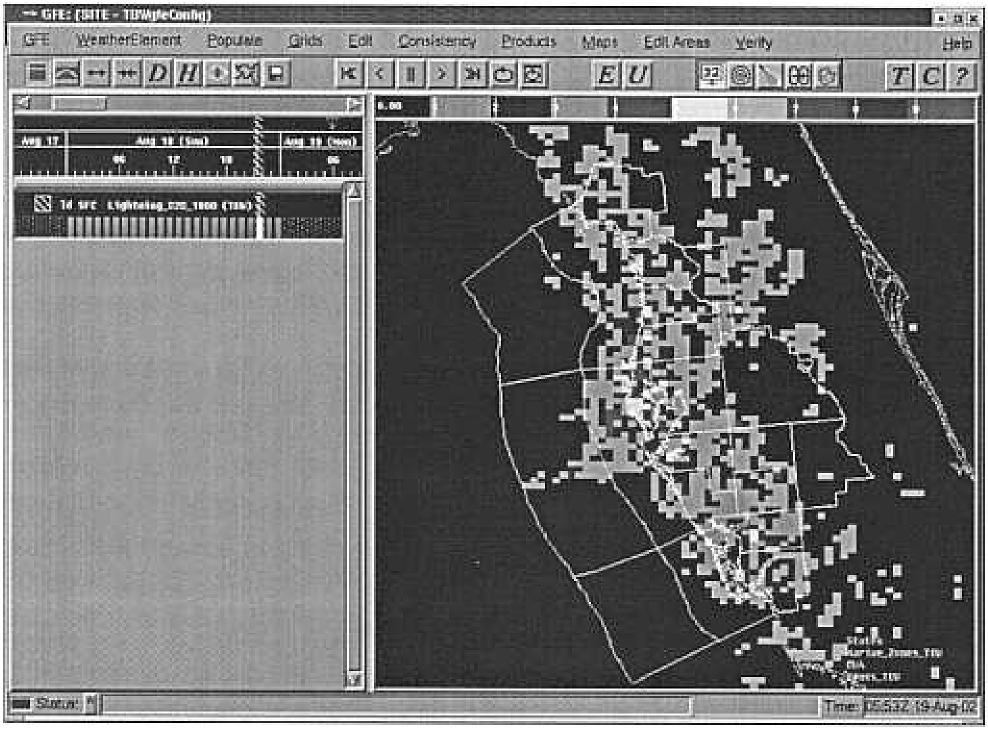

Figure 2. The GFE interface showing 24 lightning grids in the grid manager (left) and lightning grid in the spatial editor (right.)